Drum Flap

The invention relates to a drum flap, in particular for distributing air in a motor vehicle ventilation system, as described in the preamble of claim 1.

Drum flaps which have a rim running around the outside in order to increase the stability and to form a seal are known. Drum flaps of this type still leave something to be desired in terms of their leaktightness.

An air flap with a surrounding rim is also known from DE 100 53 814 A1, but this air flap deviates from a cylindrical shape.

DE 198 19 280 A1 has disclosed an air distribution apparatus with drum flap which comprises a housing with a cylindrical wall including at least two air passage openings, a flap mounted pivotably with respect to an axis of rotation and a generally cylindrical closure wall, which is mounted movably in relation to a flap body comprising two side parts, in a direction which is approximately radial with respect to the axis of rotation of the flap, with this movement being effected by adjustment means which are synchronized with the rotation of the flap, with the result that the closure wall can be moved away from the wall when the flap is in an opening position, and with the result that the closure wall can be moved toward the wall of the

housing when said flap is in a closure position. An air distribution apparatus of this type has a large number of components and a complicated construction, making it too expensive to produce.

It is an object of the invention to provide an improved drum flap.

This object is achieved by a drum flap having the features of claim 1. Advantageous configurations form the subject matter of the subclaims.

The invention provides a drum flap having a curved surface, which forms a first region, and two circle-segment surfaces, which each form a second region, and having a rim which runs around the outside, is arranged substantially in two planes, in which the pivot axis also lies, projects outward and serves to bear against correspondingly designed bearing surfaces, which drum flap has at least a second rim. This second rim serves in particular to improve the sealing, so that one drum flap can be used to control a plurality of, for example four, air passages, and when the rims bear against corresponding stops, there is no undesirable cross-flow on the part of the air. The curved surface is designed, for example, as a part-cylinder surface or a part-sphere surface.

According to a first embodiment, the second rim is provided in the first region and preferably also the second region of the drum flap. The second rim is preferably arranged in a plane in which the pivot axis also lies and projects outward, the plane in which the second rim lies being arranged in an angle between the two other planes in which the first rim lies. In this case, it is preferable for at least one opening to be provided in at least one segment of the first and/or second region, the corresponding segment being delimited by two adjacent rims, so that it is possible

to reliably prevent a cross-flow of air. To prevent a cross-flow of the air in the region of the pivot axis and to increase the stability of the drum flap, it is preferable for a circular region with a thickness designed to match that of the rims to be provided in the region of the pivot axis.

According to a second embodiment, the second rim runs substantially around a third region, which directly or indirectly, separated by an intermediate region, adjoins the lateral surface in the region of the first rim. This third region is preferably approximately rectangular in form, although it may also take a different form, surrounded by a second rim, which is used in particular for sealing purposes, so that a cross-flow can be prevented.

It is preferable for the planes in which the third region and the intermediate region lie to be arranged at an angle not equal to 180° with respect to one another. In this context, it is preferable to use an angle of less than 180° to 120°.

The drum flap is preferably used as an air distributor flap and/or as a temperature mixing flap in a motor vehicle air-conditioning system, the drum flap according to the first embodiment preferably serving as an air distributor flap, and the drum flap according to the second embodiment preferably serving as a temperature mixing flap.

In the text which follows, the invention is explained in detail on the basis of four exemplary embodiments and with reference to the drawing, in which:

Fig. 1 shows a perspective view of a drum flap in accordance with the first exemplary embodiment,

Fig. 2 shows the drum flap from Fig. 1 from a different perspective,

Fig. 3 shows a side view of the drum flap from Fig. 1 in order to illustrate its function in a first position,

Fig. 4 shows a side view of the drum flap from Fig. 1 is a second position,

Fig. 5 shows a perspective view of a drum flap in accordance with the second exemplary embodiment,

Fig. 6 shows a perspective view of a drum flap in accordance with the third exemplary embodiment,

Fig. 7 shows the drum flap from Fig. 6 from a different perspective,

Fig. 8 shows a detail view of region E from Fig. 7,

Fig. 9 shows the drum flap from Fig. 6 from a different perspective,

Fig. 10 shows a detail view of region D from Fig. 9,

Fig. 11 shows a side view of the drum flap from Fig. 6 with two detail views,

Fig. 12a-c show three views of a motor vehicle air-conditioning system with the drum flap from Fig. 6 in different positions,

Fig. 13 shows a perspective view of a second motor vehicle air-conditioning system

with two drum flaps,

Fig. 14 shows the air-conditioning system from Fig. 13 from a different perspective,

Fig. 15a-f show side views of the air-conditioning system from Fig. 13 with various flap positions, and

Fig. 16 shows the drum flap in accordance with the fourth exemplary embodiment used in the air-conditioning system from Fig. 13 in the form of a perspective illustration.

A drum flap 1 as used in particular in a motor vehicle air-conditioning system has a first region 2, which is formed by a subregion of a cylinder, and two second regions 3, which are formed by the circle segments of the side faces of the corresponding cylinder. The transition region is rounded in form. As in conventional drum flaps, a rim 4, protruding perpendicularly outward, runs around the edge of the first and second regions 2 and 3 respectively. This rim 4 forms a bearing surface which at the same time, by interacting with an associated second bearing surface formed on the air guidance housing of the air-conditioning system, also has a sealing function.

Next to the first rim 4 there is a second rim 5, which like the first rim 4 runs in a plane in which the pivot axis of the drum flap 1 also lies. In this case, the second rim 5 divides the first and second regions 2 and 3 in each case into two segments 2′ and 2″ or 3′ and 3″, respectively. According to the first exemplary embodiment, an opening (side opening) is provided in each of the segments 3″ of the second region 3, whereas the segments 2′, 2″ and 3′ are formed without openings.

To mount the drum flap 1, two bearing journals 6, which in the installed state are mounted in bearings are provided in the pivot axis. A circular region 7, which is part of the first and second rims 4 and 5 and also has a sealing function, is provided around the bearing journals 6.

Figures 3 and 4 illustrate two positions of the drum flap 1 which is installed in an air-conditioning system, is used as an air distributor flap and serves to control the distribution of air between three air passages, namely the defrosting air passage, indicated in Figures 3 and 4 by "defrost", the footwell air passage, indicated in Figures 3 and 4, by "footwell", and the ventilation air passage, indicated in Figures 3 and 4 by "ventilation". The airflow is represented by arrows.

Fig. 3 shows a flap position in which a large amount of air is being fed to the windshield for defrosting purposes and some air is being fed to the vehicle interior compartment via the side opening. The footwell air passage is closed.

In the flap position shown in Fig. 4, the defrosting air passage is closed, some air is passing into the footwell air passage via the side opening and the ventilation air passage is fully open.

According to a second exemplary embodiment, which is illustrated in Fig. 5, an opening (front opening) is also provided in segment 2". Other arrangements of openings, for example an offset arrangement of side and front openings in individual segments, are possible. In this exemplary embodiment too, there are two rims 4 and 5 which are used for sealing purposes.

A drum flap 101 in accordance with the third exemplary embodiment is illustrated in Figures 6 to 11. In this

case, the drum flap 101 has a first region 102, which is formed by a subregion of a cylinder, and two second regions 103, which are formed by circle segments of the side faces of the corresponding cylinder. The transition region is rounded in form. As in conventional drum flaps, a rim 104, protruding perpendicularly outward, runs around the edge of the first and second regions 102 and 103, respectively. This rim 104 forms a bearing surface which, in the same way as the rim 4 of the first and second exemplary embodiments, by interacting with an associated second bearing surface formed on the air guidance housing of the air-conditioning system, at the same time also has a sealing function.

As can be seen in particular from Fig. 8, the first region 102 is adjoined by a third region 110, which is rectangular in form and is delimited on one side by the corresponding rim 104 and on the other three sides by a second rim 105. The transition between the rims 104 and 105 is formed in sealing fashion, so that in principle the two regions 102 and 110 are each completely surrounded by a delimiting rim and are therefore sealed off independently of one another when the corresponding rim bears against a bearing surface.

Figures 12a to 12c illustrate a motor vehicle air-conditioning system 220 having a fan 221, an evaporator 222, a radiator 223, a drum flap 201, which corresponds to the drum flap of the third exemplary embodiment, and a mixing space 224. In this case, the drum flap 201 in Fig. 12a blocks off the passage of air through the radiator 223, so that the air fed to the vehicle interior compartment is cooled to its maximum extent.

Fig. 12b illustrates an intermediate position of the drum flap 201, while Fig. 12c illustrates a position in which all of the air is passed through the radiator 223 and therefore heated to the maximum extent. As can be

seen in Figures 12a to 12c, in the limit positions the drum flap 201 bears against stops 225 which are formed on the air guidance housing of the air-conditioning system 220. The rims 205 and 210 ensure that no air passes into the mixing space 224 in the closed position.

Figures 13 to 15f show a second motor vehicle air-conditioning system 320, having a fan 321, an evaporator 322, a radiator 323, a first drum flap 301, which serves as a distributor flap and corresponds to the drum flap of the first exemplary embodiment, and a second drum flap 301', which serves as a temperature mixing flap, is illustrated in more detail in Fig. 16 and is described in more detail below, as well as a mixing space 224.

The first drum flap 301 is used to distribute the air between a plurality of air passages, namely the air passage 331, which leads to the center nozzle, the air passage 332, which leads to the side nozzle, the air passage 333, which leads to the footwell, and the air passage 334, which is used to defrost the windshield.

The second drum flap 301', which as seen in the direction of airflow is arranged upstream of the first drum flap 301, has a first region 302, which is formed by a subregion of a cylinder, and two second regions 303, which are formed by the circle segments of the side faces of the corresponding cylinder. The transition region is rounded in form. As in the drum flaps 1 and 101 described above, a rim 304, protruding perpendicularly outward, runs around the edge of the first and second regions 302 and 303. This rim 304 forms a bearing surface which, like the rims of the exemplary embodiments described above, by interacting with an associated second bearing surface formed on the air guidance housing of the air-conditioning system, at the same time also has a sealing function.

As can be seen from Fig. 16, an intermediate region 340 adjoins the first region 302 and is in turn adjoined by a third region 310 which is rectangular in form. In this case, the third region 310 is delimited by a second rim 305 on all four sides. In the present case, the intermediate region 340 and the third region 310 are arranged at an angle of approx. 140° with respect to one another, to enable complete sealing of the flow path of the air through the radiator 323 to be avoided (cf. for example Fig. 15c), since the rims 304 and 305 bear tightly against bearing surfaces formed by the air guidance housing. The width of the intermediate region 340 approximately corresponds to the thickness of the radiator 323.

According to the present exemplary embodiment, the intermediate region 340 and the third region 310 are arranged at an angle not equal to 180° with respect to one another, although it is also possible for them both to be arranged in one plane.

The fan 321 draws in fresh air or recirculated air, as illustrated by an arrow in the top right of Fig. 14. This air is passed through the evaporator 322 and, depending on the position of the second drum flap 301', bypasses the radiator 323 and/or is passed through the latter. The air is mixed in the mixing space 324 if the second drum flap 301' splits the air stream. Then, depending on the position of the first drum flap 301, the air is distributed between the air passages 331, 332, 333 and 334 and is fed to the vehicle interior compartment.

Various positions of the two drum flaps 301 and 301' are illustrated in Fig. 15a to 15f. Fig. 15a shows the "maximum heating" position of the second drum flap 301', in which the warm air is fed to the windshield in order to defrost it and to the side nozzle, i.e. the

air passages 332 and 334 are opened up while the air passages 331 and 333 are tightly closed.

Fig. 15b shows a mix position of the second drum flap 301', so that the warm and cold air is mixed in the mixing space 324. The position of the first drum flap 301 corresponds to that shown in Fig. 15a, so that the air, the temperature of which has been controlled according to the opening of the second drum flap 301', is fed to the windshield in order to defrost the latter and to the side nozzle. According to Fig. 15c, cold air is fed to the windshield in order to defrost the latter and to the side nozzle, since the second drum flap 301', on account of its configuration, is tightly blocking the path through the radiator 323, specifically both from the front and from the rear.

Fig. 15d once again shows the "maximum heating" position of the second drum flap 301' (cf. Fig. 15a), but with the first drum flap 301 pivoted in such a manner that the air is fed to the vehicle interior compartment via the air passages 331, 332 and 333 while the air passage 334 is closed. The precision setting of the air distribution between these three air passages can be effected in situ by means of the corresponding nozzles. Fig. 15e shows a corresponding air distribution for maximum cooled air and Fig. 15f shows the corresponding air distribution for temperature-controlled air.

On account of their correspondingly configured rims, the drum flaps of all the exemplary embodiments allow good sealing between the drum flap and the corresponding bearing surfaces, so that optimized temperature control of the air is possible.

List of Designations

1, 101, 201, 301, 301' drum flap
2, 102, 302 first region
2',2" segment
3, 103, 303 second region
3', 3" segment
4, 104, 304 first rim
5, 105, 305 second rim
6 bearing journal
7 circular region
110, 310 third region
220, 320 air-conditioning system
221, 321 fan
222, 322 evaporator
223, 323 radiator
224, 324 mixing space
225 bearing surface
331, 332, 333, 334 air passage
340 intermediate region